IES Institute of Education Sciences

Pre-K Mathematics

Intervention Brief | *Preparing Young Children for School*

WHAT WORKS CLEARINGHOUSE™
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Pre-K Mathematics is a supplemental mathematics program focusing on a range of mathematical concepts to help develop children's informal mathematical knowledge. The *Pre-K Mathematics* program includes teacher-led, small-group mathematics activities that are engaging and hands-on, as well as caregiver-child activities that are linked to the classroom activities to support children's math learning at home.

Goal: *Pre-K Mathematics* aims to develop preschool children's informal mathematical knowledge, using engaging classroom and home math activities.

The What Works Clearinghouse (WWC) reviews existing research on educational interventions to identify evidence-based programs and practices. This WWC intervention report summarizes the available evidence on the effects of *Pre-K Mathematics* on student outcomes.

Did *Pre-K Mathematics* improve student outcomes?

Five studies of the *Pre-K Mathematics* program meet WWC standards. These studies were conducted in Head Start and state-funded preschool sites. Findings from these studies are summarized in Table 1. The table includes a row for each outcome domain that was studied in the research. An outcome domain includes a group of related outcome measures. The *Pre-K Mathematics* studies primarily included measures that fit within the mathematics domain, but also examined outcomes within the language, reading & literacy related, self-regulation, and social-emotional learning outcome domains. Effects of the program on other outcome domains are unknown.

The WWC effectiveness rating indicates whether the *Pre-K Mathematics* program resulted in improved outcomes for children assigned to receive the program compared with children who were not. The table also indicates whether the evidence reviewed satisfies the Department of Education's requirements for strong, moderate, or promising tiers of evidence at the time this report was written. More information about these ratings and requirements is provided on the next page. Findings and conclusions could change as new research becomes available.

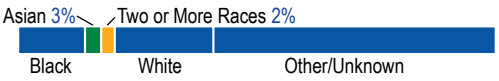
Table 1. Summary of findings on *Pre-K Mathematics* from five studies that meet WWC standards

Outcome domain	Effectiveness rating	Sample size	Evidence tier	Summary of impacts
Mathematics	Positive effects	2,913	TIER 1 STRONG	The research provides strong evidence that *Pre-K Mathematics* improved student mathematics achievement. This assessment is based on five studies that meet WWC standards.
Language	Uncertain effects	296	NO TIER ASSIGNED	The research does not support claims that *Pre-K Mathematics* improved student language. This assessment is based on one study that meets WWC standards.
Reading & Literacy Related	Uncertain effects	966	NO TIER ASSIGNED	The research does not support claims that *Pre-K Mathematics* improved student reading & literacy related achievement. This assessment is based on two studies that meet WWC standards.
Self-Regulation	Uncertain effects	234	NO TIER ASSIGNED	The research does not support claims that *Pre-K Mathematics* improved student self-regulation. This assessment is based on one study that meets WWC standards.
Social-Emotional Learning	Uncertain effects	297	NO TIER ASSIGNED	The research does not support claims that *Pre-K Mathematics* improved student social-emotional learning. This assessment is based on one study that meets WWC standards.

CHARACTERISTICS OF THE STUDY SETTING AND PARTICIPANTS

Settings: Head Start and state-funded preschool sites in the United States.

Race:



Hispanic/Latino: 56%

Female: 52%

Families with incomes below the federal poverty guidelines: 100%

HOW THE WWC REVIEWS AND DESCRIBES EVIDENCE

The WWC conducted a systematic review of interventions designed to improve children's level of preparation for school and selected and prioritized studies for review using the version 4.1 Review Protocol for *Preparing Young Children for School*. The WWC evaluated the quality and results of the selected studies using the criteria outlined in the version 4.1 Procedures and Standards Handbooks and the accompanying Review Protocol for *Preparing Young Children for School*.

The WWC considers each study's research design, whether findings were statistically significant and positive, and the number of studies contributing to this report. The WWC synthesizes evidence across studies—using a weighted average—to determine the effectiveness rating for each outcome domain. The WWC defines outcome domains in the Review Protocol for *Preparing Young Children for School*.

Effectiveness rating	Description of the evidence
Positive (or negative) effects	The evidence base primarily includes the strongest research designs, and the average effect across all high-quality research is statistically significant and positive (or negative).
Potentially positive (or negative) effects	The evidence base primarily includes research with some limitations, and the average effect across all high-quality research is statistically significant and positive (or negative).
Uncertain effects	The average effect across all high-quality research is not statistically significant, so the WWC does not classify it as a positive or a negative effect.

The WWC considers the effectiveness rating, the sample size, and the number of educational sites (states, districts, local education agencies, schools, postsecondary campuses) across studies to determine the evidence tier for each outcome domain. When the effectiveness rating is *uncertain*, *potentially negative*, or *negative effects*, there is no evidence tier.

Evidence tier		Criteria based on evidence synthesis
Strong evidence of effectiveness	TIER 1 STRONG	• Receives an effectiveness rating of positive effects, and • Includes at least 350 students from at least two educational sites
Moderate evidence of effectiveness	TIER 2 MODERATE	• Receives an effectiveness rating of potentially positive effects, and • Includes at least 350 students from at least two educational sites
Promising evidence of effectiveness	TIER 3 PROMISING	• Receives an effectiveness rating of potentially positive effects or positive effects, and • Includes fewer than 350 students or two educational sites

How was *Pre-K Mathematics* implemented?

This section provides details of how Head Start and state-funded preschool sites implemented *Pre-K Mathematics* in the five studies that contribute to this intervention report. This information can help educators identify the requirements for implementing *Pre-K Mathematics* and determine whether implementing this program would be feasible in their districts, schools, or early childhood education centers.

Teachers implementing *Pre-K Mathematics* in their classrooms received training and coaching and a set of materials provided by the developer. Teachers implemented *Pre-K Mathematics* activities in small-group sessions with 4–6 children lasting approximately 15–20 minutes, twice a week for 24–29 weeks. Also, every 1–2 weeks teachers sent home a packet containing a caregiver-child math activity, manipulatives, and a caregiver letter (in English or Spanish) with information about how to do the activity at home. Some teachers also provided children with opportunities to use math software for 5–10 minutes, twice per week during center time.[1]

Comparison group: In the five studies that contribute to this intervention report, children in the comparison group were taught by teachers who did not participate in *Pre-K Mathematics* training and did not implement the *Pre-K Mathematics* sessions. Teachers may have participated in other training offered by their district, school, or early childhood education center.

WWC standards assess the quality of the research, not the quality of the implementation. Studies that meet WWC standards vary in quality of implementation. However, a study must describe the relevant components of the intervention and how each was implemented with adequate detail to be included in an intervention report. Table 2 identifies and describes the components of the program that were implemented in the studies.

Table 2. Implementation of components of *Pre-K Mathematics*

Component	Description of the component	How it was implemented
Classroom math activities	A set of 24 in-class, small-group activities with manipulatives that are intended to develop children's informal mathematical knowledge.	The program offered a new hands-on mathematics activity each week. Each new activity was conducted twice a week for 15–20 minutes in teacher-led small groups consisting of 4–6 children. The activities focused on a range of math concepts, including number sense, arithmetic operations, spatial sense and geometry, pattern knowledge, and measurement and data. Each activity included a core lesson as well as additional activities to tailor the lesson for lower- and higher-performing children. Suggestions for scaffolding to address common child errors or misunderstandings were also provided for each lesson.
Home math activities	A set of 24 caregiver-child math activities linked to the in-class activities that can be used at home to support mathematics learning.	The caregiver letters included a brief explanation of the caregiver-child activity and its purpose, and a picture strip depicting how to conduct the activity at home. The letters were written in English and Spanish. Teachers sent the letters home with manipulatives every 1–2 weeks.
Mathematics software	The software was used to provide children with practice opportunities.	Some teachers loaded mathematics software (e.g., *DLM Early Childhood Express*) on a classroom computer and included it as a center that children could use. Children were encouraged to visit the center for 5–10 minutes twice a week during center time.

Note: The descriptive information for this intervention comes from the intervention website https://prekmath.wested.org/, the five studies that meet WWC standards, and correspondence with the developer. The WWC requests that developers review the intervention description sections for accuracy from their perspective. The WWC provided the developer with the intervention description in January 2023, and the WWC incorporated feedback from the developer.

How much does *Pre-K Mathematics* cost?

This section provides educators with an overview of the resources needed to implement *Pre-K Mathematics*. Table 3 describes the major resources needed for implementation and approximate costs.

Table 3. Resources needed to implement *Pre-K Mathematics*

Resource	Description	Cost
Teacher training	According to the developer, teachers need 4 days of professional development. The training includes instruction in how to implement the curriculum with fidelity, practice conducting the activities, and training in progress monitoring.	The *Pre-K Mathematics* package includes teacher training, curriculum coaching, and materials. Pricing for this package varies by the number of teachers and classrooms. For example, the total cost for 16 teachers from 8 classrooms and 1–2 curriculum coaches is $51,000; the cost for 16 teachers from 16 classrooms and 1–2 curriculum coaches is $61,000; the cost for 24 teachers from 24 classrooms and 1–2 curriculum coaches is $71,500.
Curriculum coaching	According to the developer, teachers need ongoing in-class coaching for the initial year of implementation. The coaching includes observations of the teachers implementing the program and feedback for the teachers. The teacher and coach discuss 1–2 issues per session and possible solutions. Coaches can, for example, be members of a preschool site's professional development staff. They are trained with the teachers during teacher training and receive an additional day of coach-specific training.	
Materials	The developer provides a set of teacher materials (a curriculum binder, a master set of reproducible home activities, and a manipulatives kit) for implementing the program. Each binder includes a generic curriculum plan with classroom activities, embedded math knowledge, and opportunities for review. The binder also includes additional activities for lower- and higher-performing children and recording sheets to monitor children's progress in mastering the activities. Manipulatives in the kit are organized by the math activities included in the curriculum binder.	

For More Information:

About *Pre-K Mathematics*
Email: prekmath@wested.org
Web: https://prekmath.wested.org/

LEARN MORE

Read the full intervention report to learn more about *Pre-K Mathematics*, how it was implemented in the studies that meet standards, and what the studies found. Visit the WWC website for a summary of evidence on the effects of *Pre-K Mathematics*.

[1] A mathematics software component was used in four of the five studies. *DLM Early Childhood Express* software was present in one of the five studies, and other math software was used in three of the five studies. The impact of this additional component cannot be separated from the impact of the *Pre-K Mathematics* curriculum. However, because mathematics software can be used with *Pre-K Mathematics*, the WWC considers the information in this report to be useful for practitioners in search of a preschool mathematics curriculum.